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SOME EDIBLE AND POISONOUS MUSHROOMS OF COLORADO

By B. O. LONGYEAR



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SOME EDIBLE AND POISONOUS MUSHROOMS OF COLORADO

By B. O. Longyear

Many persons, no doubt, would make use of our native wild mushrooms were it not for fear of mistaking a poisonous for an edible kind. It is the purpose of this bulletin to make possible a better understanding of this class of fungous growths for those who would like to gather them for food, and to enable such persons to become acquainted with our most common and easily recognized species.

Altho the edible fungi are generally less plentiful in Colorado than in the more humid sections of the country still there are times when they can be found in sufficient quantities to make them of considerable importance. Under irrigated conditions, too, some kinds are apt to be as plentiful as elsewhere and should be utilized instead of being allowed to go to waste or of being destroyed, as is often the case.

The raising of mushrooms under cultivation, is a distinct subject but is given brief description based largely upon standard sources of information rather than upon personal experience.

There is no one class of plants, probably, which is so little understood by the public as that which includes those commonly called mushrooms and toadstools. Hence, the question which a person having some knowledge of these fungi is sure to be asked is, "How do you tell a mushroom from a toadstool?" This question is based on the popular notion that there are just two kinds of these plants, mushrooms, edible, and toadstools, poisonous. As no such distinction exists, however, the botanist understands, of course, that this question really means, "How can a person learn to recognize the edible species of fleshy fungi and to avoid the poisonous species?"

If any person were asked, "How do you tell carrots from beets, asparagus from lettuce, or tomato plants from potato plants?" the answer would properly be, "By their differences in the shape, the color and the taste of their roots, by the structure and shape of their leaves, and by their flowers and fruits," or in fact by their botanical characters.

The logical reply to the first question therefore is, "Learn to know the fungi by their botanical characters." Most persons, however, who ask this question could not readily describe the distinctions, perhaps, between the different garden vegetables above mentioned but would be apt to say, "Why everybody knows

them." And this is what the person who wishes to identify the edible species of mushrooms and toadstools as a food product should do, become so familiar with them that he can recognize them at sight, as he does the common plants of the garden or the markets.

But how may a person become familiar with the edible kinds of mushrooms and toadstools? In general there are three ways of acquiring this information. First, anyone who can spend some time with a person who already knows the common edible kinds can readily learn to know them for himself, by personal instruction. Second, by studying bulletins or books which contain descriptions and pictures of these plants and which tell where they grow and when to look for them.

The third method may be called the physiological method which requires considerable courage and entails some risks, altho slight if carefully followed. This consists of tasting a very small fragment of the fungous without swallowing any of the juice. If no unpleasant symptoms arise within the next twenty four hours a slightly larger piece may be chewed and some of the juice swallowed. Providing no symptoms of poisoning follow within the next twenty-four hours a larger piece may be eaten and the results noted. In this careful manner and with the imagination under good control a person who desires to extend his acquaintance with merely the edible qualities of fungi may do so without real danger.

By the last method some students of fungi have learned that the number of really dangerous species is very small as compared with the edible ones. One interesting way to learn a good deal about the edible properties of the fleshy fungi which grow in our mountain forests is by watching the use made of them by the squirrels. These little animals, both the striped and the gray squirrels, seem to possess an instinctive ability to distinguish between the edible and the poisonous species of mushrooms which grow in their haunts. They furthermore make no small part of their diet upon these plants, gnawed remnants of which are to be found frequently during the mushroom season.

But is there not some simpler way than any of these, some easy method by which a test can be applied to the mushrooms which will tell whether they are poisonous or not? No, there is not, any more than there is with other plants. No dependence should be placed upon the blackening of a silver spoon in cooking. Nor in any change of color when salt is placed on any part of the fungus, nor upon bright colors of the mushroom nor upon whether or not the caps will peel readily, in fact no general single rule nor set of rules is to be recommended.

The person who goes out to gather herbs for a mess of greens does not have any set of rules to go by in selecting the plants used except to avoid those with which he is unfamiliar and use those which he has learned to recognize as suitable for this purpose. And this is probably the safest method to use in gathering mushrooms for food, learn to know certain kinds and avoid those that are unfamiliar until they have been found to be edible by some of the means first described.

THE NATURE AND GROWTH OF FUNGI

Mushrooms and toadstools belong to that great class of lowly plants known as Fungi. While they differ widely in size, structure, and habits of growth, all species of fungi have certain characters in common. They are without flowers and are entirely destitute in all stages of growth of the green coloring matter, chlorophyll, found especially in those plants which bear true foliage. On account of the absence of this chlorophyll, the fungi are dependent plants and must gain their livelihood either at the expense of other living plants or must feed upon the dead remains of such plants.

In the first case they are parasites, such as the smuts, rusts, mildews and other disease-producing organisms of the higher



Fig. 1. A mass of decaying leaves covered with delicate filaments of some fungus which is causing their decay.

plants. The mushroom fungi belong mainly to the second division, those which live upon dead and decaying organic matter, such as leaves, wood, straw, and manure, or similar substances. In fact, the decay of such material is largely due to the presence of these fungi in their vegetative stage of growth.

During this early vegetative period of a fungus, it consists of delicate, cobweb-like filaments or threads which are almost too slender to be seen with the unaided eye unless they are very numerous and massed together, when they give a moldy appearance to the material upon which they are growing. Under the high powers of the microscope these delicate filaments are seen to be thin-walled tubes which branch and unite to form an intricate network somewhat like the root system of a flowering plant. This network of minute tubular threads, known as mycelium, grows rapidly under proper conditions of moisture and heat and dissolves and absorbs the nutritive substances in the material upon which it grows. If this happens to be a mass of fallen leaves, a pile of manure or a piece of wood, these materials soon show the signs of decay. Most fungi require an abundance of moisture to enable them to grow. For this reason, the mushroom crop is especially abundant during or following a period of wet weather and it is a matter of common knowledge that vegetable matter will not decay as long as it is kept dry.

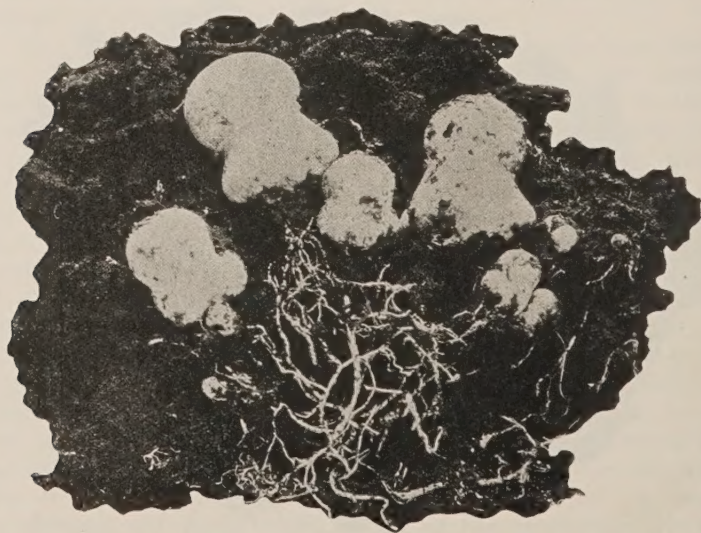


Fig. 2. Root-like strands of mycelium of the common cultivated mushroom giving rise to the button stage of the fungus. This shows how the little mushrooms are formed in the mushroom bed.

After a fungus has grown in its vegetative stage until it has accumulated a supply of reserve food material and has formed a well developed mycelial system, it may begin to produce its fruiting stage in the form of the mature mushroom or toadstool. A great many of the little threads of mycelium may unite to form root-like strands which in turn give rise to small globular bodies, the future mushrooms. This process usually takes place a little below the surface of the soil, the mass of leaves or other decaying vegetation, or upon the surface, if it is a decaying log or stump. These little bodies rapidly increase in size until they are prepared to expand into the mature mushroom. In some species of fleshy fungi this last stage of growth is very rapid so that these plants appear to spring up in a night, while in others it requires several days for the complete unfolding of the fruiting part.

SPORES

During this period of expanding to full size, the mushroom is also maturing an abundance of spores. Spores are the minute bodies by means of which the fungus is able to start a new generation elsewhere or to reproduce itself. They are so small that in some fungi a compact mass of spores as large as the head of a parlor match could contain as many as ten millions of these microscopic bodies, enough to cover an acre and a half at the rate of one spore to each square inch of surface. Their minute size



Fig. 3



Fig. 4

Fig. 3. Fungous spores showing a variety of shapes as found in different kinds of fungi. Highly magnified.

Fig. 4. Spores of the common mushroom germinating. Each one is sending out a thin-walled tube which is the beginning of the network of mycelium of the fungus. Highly magnified.

enables them to float readily in the air like the finest particles of dust and it is only when large numbers of them are thrown into the air at one time, as from a mature puff ball, that we are able to see them as a miniature cloud of smoke. The enormous number of spores which even one mushroom may shed readily

accounts for the ease with which these plants find every suitable place in which to grow.

When the spores of fungi fall into a suitable condition of moisture and heat and with the proper food supply at hand, they may germinate by sending out a slender germ tube. This germ tube begins at once to gather nourishment from the material suited to its growth and in this way a new colony of the fungus is soon established. Frequently a period of drought may set in after the mycelium has reached a considerable growth. In such a case it may dry up for a time to be started into activity again when the moisture supply is renewed. This is the condition in which mushroom spawn is sold for the starting of mushroom beds, the so-called bricks or flakes being compact masses of half decomposed manure filled with the mycelium of the cultivated variety of the common meadow mushroom.

THE STRUCTURE OF FUNGI

In structure the tissues of a fungus are much simpler than those of other plants. If a small fragment of the flesh of a mushroom is examined under the higher power of a compound microscope it will appear to be made up of interwoven thin-walled, freely branched tubes which are divided at frequent intervals by thin cross-walls into more or less elongated cells. Thus the body of the fungus is found to be made up of the same filaments which form its mycelium; in fact, it is a continuation of the mycelial threads thickly interlaced and partly grown together. In the denser parts of some hard and woody fungi the cells of the tubular filaments are thick-walled, short and entirely grown together, while in the soft kinds the mycelial tubes are loosely interwoven, thin-walled, and have fewer partitions.

The cells thus formed contain varying amounts of water and protoplasm, the living substance of the plant. This protoplasm is usually nearly colorless and appears minutely granular with larger particles of food material floating within it.

HOW THE LARGER FUNGI ARE CLASSIFIED

All of the larger fungi, including both the fleshy and the unedible woody kinds, are arranged by botanists in two classes according to the manner in which their spores are borne:

- I. Fungi which bear their spores in tiny sacs (asci). *Ascomycetes*
- II. Fungi which bear their spores upon the ends of certain cells (basidia) *Basidiomycetes*

The cells which bear the spores, (asci or basidia), are crowded together, usually, so as to form a spore-bearing layer (hymenium)

upon some definite part of the fungus. The general form of the fungus together with the shape of the parts upon which the hymenium or spore-bearing surface occurs are some of the principal characters by which the botanist recognizes a fungus. Fortunately the use of a microscope is not necessary for a person to determine these matters in learning the names of the more common edible fungi. But it is necessary that one be able to recognize the location of the hymenium or spore-bearing layer and to note the shape of the part of the fungus which bears it, together with the color of the spores, especially in certain species.

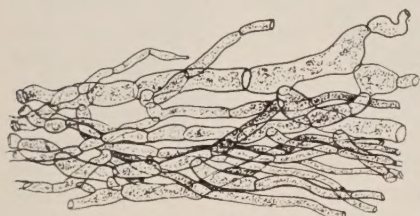


Fig. 5

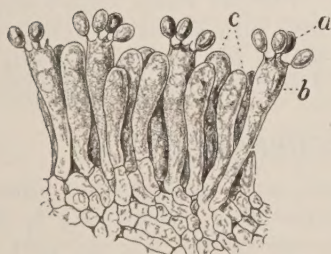


Fig. 6



Fig. 7

Fig. 5. Small portion of the tissue of a mushroom showing the tubular filaments which go to make up the flesh of the softer part of the fungus. Highly magnified.

Fig. 6. Small portion of the spore-bearing layer of one of the fungi belonging to the class *Basidiomycetes*. The spores (a) are produced on the ends of little stalk-like projections of the basidia; (b), (c), sterile cells intermingled with the basidia. Highly magnified.

Fig. 7. Small portion of the spore-bearing layer of a Morel. The spores (a) are produced inside of long thin-walled cells or sacs called Asci; (b), (c), sterile cells intermingled with the spore-bearing cells. The spores are discharged by the breaking open of the ends of the asci, as at (c). Highly magnified.

The following outline shows the classification of the various fleshy fungi described in this bulletin:

- A. Plant more or less globular or pear-shaped; spore-bearing layer (hymenium) lining the interior of irregular minute cavities all thru the upper part which later becomes filled with a dry dusty mass of spores intermingled with cottony threads.

The Puffballs

- B. Plant usually with a distinct stem or stalk bearing a variously shaped head or cap (pileus) upon which the spore-bearing layer (hymenium) is distributed in different ways; spores not forming a dry dusty mass in the upper part of the plant.
1. Head or cap (pileus) with sponge-like appearance due to irregular pits and folds or wrinkles upon its surface.
 - (a) Plant developed above ground; spores of the mature plant not visible and having no unpleasant odor.

The Morels
 - (b) Plant developed below ground in an egg-shaped sack from which it bursts and arises; spores forming a slimy dark mass upon the cap and having a strong carrion-like odor.

The Stinkhorn Fungi
 2. Head or cap (pileus) mostly umbrella-shaped or conical, with central stem, or shell-shaped with eccentric stem, usually smooth above; spore-bearing layer (hymenium) on under surface of cap; spores of mature plant often visible as a fine powder upon the spore-bearing surface.
 - (a) Under surface of cap or pileus with numerous radiating gills or thin plates upon which the spores are borne.

The Gill Fungi (Agaricaceae)
 3. Under surface of cap or pileus with numerous fine holes or perforations within which the spores are borne.

The Pore Fungi (Polyporaceae)

SEASON OF OCCURRENCE

While some species of mushrooms occur during only a limited part of the growing season, there are others which may be expected to appear almost any time during the warmer part of the year, especially soon after a period of rainy weather.

Among those which are described in this bulletin the morels are confined to the spring while the coprinus mushrooms occur almost thruout the season. The puffballs, the oyster mushrooms, the common mushroom and the boletus are found principally during the summer months altho some of them may be found until autumn frosts occur.

The poisonous *am-nita* and the Morgan's *lepiota* are usually confined to the summer and early autumn months. The smooth *lepiota* begins to appear in late summer and lasts well into the autumn.

THE MORELS

Among the earliest mushrooms to be looked for in spring are the Morels. They appear principally during the month of

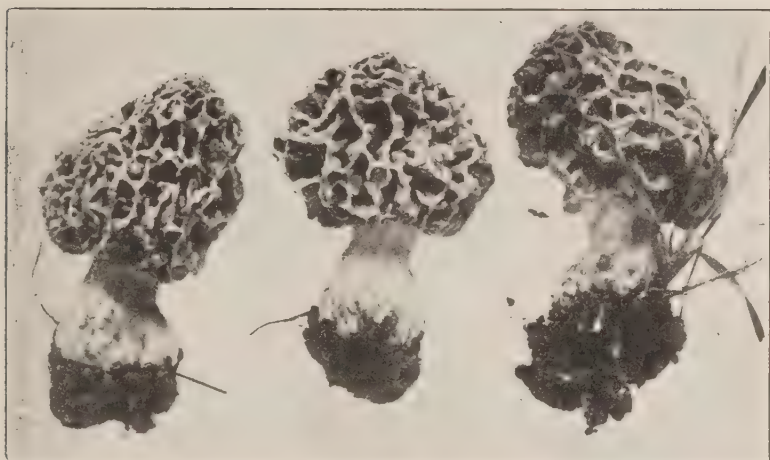


Fig. 8. Specimens of the common Morel (*Morchella esculenta*)

May and then disappear during the remainder of the season. Apparently these fungi complete their growth of mycelium during summer and autumn and are then ready to produce the fruiting part early in the following spring. They belong to the class *Ascomycetes* in which the spores are produced within the fertile cells of the hymenium or spore-bearing layer.

Upon examining a mature specimen two parts are noticed: (1) A hollow stem; (2) a head or cap borne at the top of the stem and known botanically as the pileus. While at least five species of Morels occur in this country, only two have been found in Colorado by the author and but one of these is common.

The hymenium in the Morels covers the surface of wrinkles or variously branched ridges upon the surface of the pileus or cap and the spores are discharged into the air when the cells which contain them break open at the tips.

The Common Morel (Morchella esculenta)

This is the most familiar mushroom to many persons who often call it the "sponge mushroom" from the resemblance of its pileus or cap to a small sponge. It grows in small groups or scattered individuals especially on grassy land among the cottonwoods which border our streams and here the lover of mushrooms soon learns to look for them each spring in the same haunts. It loves the leaf mold which gathers among broad-leaf trees in particular and has been found at times in favored places upon undisturbed soil near the shade trees of a vacant city lot.

The color of the stem is nearly white, while the cap is grayish or leaden when young but acquires a buff tint as it matures. The usual size of the plant is from two to four inches in height, altho larger specimens are sometimes found.

The only fungus which might be mistaken for the Morel is the Stinkhorn fungus which not infrequently appears along sidewalks and ditch banks, bordered with cottonwood trees and even in gardens and lawns or wherever there is decaying wood in the soil. The latter fungus, however, while not dangerous, is readily recognized by the taller stem which bears a small bell-shaped pitted cap coated at first with a dark grayish green slime possessing a strong carrion-like odor. This ill-smelling fungus is at first entirely covered by a tough membrane, in which condition it somewhat resembles a small, soft-shelled egg.

When about to push above ground the fungus bursts thru this covering which is left in the ground at the base of the stem. Sometimes a whole nest of these fungous eggs may be unearthed if the soil is dug up where they occur and in this condition they are considered by some persons to be edible.

THE PUFFBALLS

Puffballs are among the most interesting members of the fleshy fungi. They occur almost everywhere, on open grassy ground, sometimes in dooryards and frequently in woodlands. Some grow only from the earth, while others may be found attached to much decayed wood.



Fig. 9. The Stinkhorn fungus. A cluster of three eggs and two mature specimens. This is the only fungus liable to be mistaken for the Morel. It is readily distinguished, however, by its powerful carrion-like odor when mature.

When young and fresh they are nearly always white in color thruout, the interior being firm and in appearance much like cottage cheese. In this condition they are prime for eating and should never be destroyed. As they mature, however, the interior portions acquire a yellowish, brownish or purplish color and a soft and watery consistency, which unfits them for food. In a few days' time the moisture dries out leaving the tougher outer part filled with a cottony mass of fibers mixed with dark colored, dusty spores. In this condition they are fit objects for the small boy with a stick who delights in making them puff out smoke-like clouds of spore dust.

The spores of puffballs are produced in clusters at the ends of the fertile cells of the hymenium or spore-bearing layer which lines the walls of small, irregular cavities within the fungus. As the puffball matures, these walls partially melt and cause the watery condition of the interior, while the spores are left mixed with thread-like cells of the walls. The fact that they are and that none of them are poisonous or harmful, so long as they puffballs are so easily recognized in every stage of their growth are firm and white inside, makes them especially desirable and safe for the novice to collect for food.

The Cup-Shaped or Purple Puffball (*Calvatia lilacina* variety *occidentalis*)

This is perhaps the commonest of our larger puffballs and is at the same time one of the best for the table. It may be looked for in meadows and in grassland that is used for pasturage. When full grown it is about once or twice the size of one's fist and has the form of a flattened sphere with a narrowed base.

At first the outer covering (peridium) is white and nearly smooth, but as the fungus matures it becomes slightly cracked into very irregular areas and acquires a purplish color. As the inside moisture evaporates the peridium gradually flakes away, exposing the purple spore-mass within. In time the wind scoops out the spores, together with the cottony threads and scatters them far and wide, leaving the hollowed-out base of the fungus attached to the ground.

The Giant Puffball (Calvatia gigantea)

This fungus is not only the Goliath of its tribe, but when well developed has no rival in size among the fleshy fungi. It frequently attains the size of a football while specimens over sixty inches in circumference and weighing more than fifteen pounds have



Fig. 10. A purple-spored puffball commonly found growing in meadows and pasture land.

been seen by the writer. While this fungus occurs not infrequently in the humid sections of the United States, it has been less commonly found in Colorado. It should be sought for in grasslands, especially of our mountain parks. A single well-developed specimen is capable of furnishing a fungus omelette for a whole neighborhood.

The surface of this puffball, when young, resembles white kid leather, while its resemblance to a large rounded mass of freshly raised bread dough is quite striking. A specimen much too large to be used by a family at one meal has sometimes been utilized during several days, or so long as no discoloration appeared, by slicing it off as desired for cooking.

The spore mass of the giant puffball is olive brown in color and is discharged as in the preceding species.

The Gemmed Puffball (Lycoperdon gemmatum).

The name of this little puffball was suggested by the fact that its surface is thickly studded with little pointed warts which fall away at maturity and leave the surface of the peridium marked with slight indentations. While the size is small, one or two inches high, it makes up for this to some extent by its numbers. It grows usually in clusters of three or four to several dozen in number, and occurs in woodlands usually about decayed wood lying on the ground.

The shape of this puffball is more elongated than that of the preceding species and instead of breaking irregularly, to discharge the spores, it opens by a small rounded mouth at the



Fig. 11. Giant puffball measuring more than 60 inches in circumference and weighing nearly 20 pounds. One of a group found at the foot of Wolf Creek Pass in Colorado.

extreme top of the plant. A mature dry specimen when suddenly pressed between the fingers, will give off repeated puffs of smoke-like spore dust, whence comes the common name of "puff-ball" applied to the plants of this character.



Fig. 12 A cluster of the gemmed puffball. This little puffball often occurs in large numbers on mossy ground in woodlands.

GILL-BEARING MUSHROOMS

(Family Agaricaceae)

The fungi composing this family are characterized by having the spore-bearing layer spread on the surface of thin, radiating plates or gills attached to the lower surface of a more or less expanded or flattened part, the cap or pileus. In the simpler members of this family, the pileus is shaped much like one of the valves of a clam shell attached by one edge to whatever the fungus is growing upon. In the more highly developed members the pileus is bell-shaped or inverted saucer-shaped and is raised upon a central stalk with the gills radiating from its upper end toward the margin of the pileus. When very young or in the button stage the pileus is mostly rounded in shape and the stem is very short, in which condition the whole plant is often egg-shaped. As the fungus is about ready to mature its spores, the stem rapidly lengthens lifting the pileus into the air, where it soon opens out and allows the spores to drop from the gills attached to its lower surface.

The spores of the gill fungi are borne upon the ends of cells called basidia the same as in the puffballs. Instead of being enclosed by the outer walls of the fungus, however, they are exposed to the air as soon as the cap or pileus expands and are thus readily cast off and wafted away by the gentlest breeze.

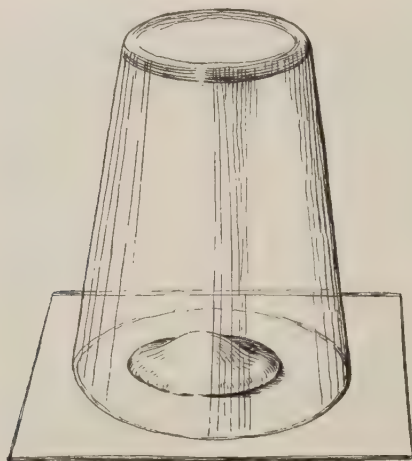


Fig. 13. Making a spore print.

SPORE PRINTS

In order to identify with certainty the members of the gill fungi or agarics, it is necessary to know the color of the spores. While this can often be told by a careful examination of the gills, which are usually powdered with the dustlike spores, it is determined most surely by making a spore print. If the cap is carefully removed from the stem and placed gills down upon a piece of white paper and covered with a tumbler or bell jar, the spores will settle upon the paper and form a spore print (Figs. 13-14). This process may require from one-half to three or four hours, depending somewhat upon the freshness of the specimen. If the spores are white, they can hardly be seen except by looking across the paper. If black paper is used for those species which have white gills, the spores will show very distinctly and if the paper is first coated with a very thin layer of mucilage the spores will be held in place and the spore prints are thus made permanent.

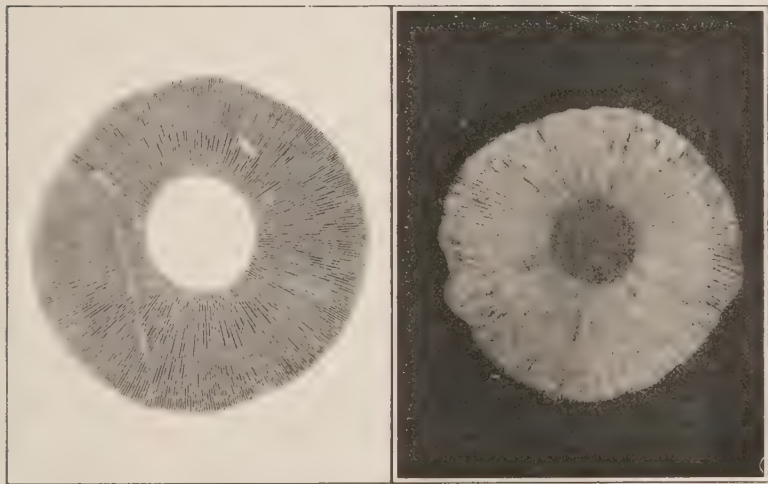


Fig. 14. Spore prints of common mushroom and of smooth *Lepiota*.

Key to the Gill Fungi herein described.

1. Spores, and usually the gills, white or tinted with pale lavender, pink, yellow or green, appearing colorless under the microscope (*Leucosporae*).

Cap with central stem; fungi growing upon the ground.
(Sometimes at base of stumps or trunks.)

Stem with a ring or collar toward the upper end.

Stem with a cup or volva at its base.

The Amanitas

Stem without a cup or volva at base.

Growing singly or in colonies on the ground.

The Lepiotas

Growing in crowded clusters near decaying wood.

Armillaria

Stem without a ring or collar.

Fresh plant exuding milky juice when wounded.

The Lactarii

Fresh plant without milky juice.

Plant very brittle; gills without notch close to the stem.

Russula

Plant not very brittle; gills with a notch close to the stem.

Tricholoma

Cap with stem from one side or sometimes lacking; fungi growing on wood.

Pleurotus

2. Spores, and often the gills, pink or rosy pink in color.

(Rhodosporae)

(No species described here.)

3. Spores, and often the gills, ochre yellow to rust brown in color (Ochrospora)

Margin of cap attached to stem by cobweb-like threads when expanding.

Cortinarius

4. Spores, and usually the gills, purplish or purple-brown.

(Porphyrospora)

Stem with a well-developed ring.

Plant small, growing on dung.

Stropharia

Plant usually large, growing on the ground or manured soil.

The Agaricus

Stem without a well-developed collar or ring.

The Hypholoma

5. Spores, and usually the gills, black (Melanosporae).

Gills melting into an inky fluid when mature.

The Coprinus

THE AMANITAS

The *Agaricus* family is the only one which contains the deadly poisonous species of fleshy fungi, the *Amanitas*. The *Amanitas* are umbrella-shaped mushrooms which in the early or button stage are in the form of egg-shaped bodies which begin just below the surface of the soil or decayed leaves where the fungus grows. Each egg consists of one fungus enclosed by a membrane or coating which splits open as the mushroom is ready to appear above the ground. The remains of this covering, known as the volva, forms a sheath or coating of loose scales around the base of the stem after the fungus is full grown, but as it is usually hidden under the surface of the soil, the base of the stem should be carefully dug up in order to show this character. In some of the *Amanitas* moreover, small portions of the upper part of the volva remain as loose patches or warts upon the top of the cap and thus help in the identifying of the specimen.



Fig. 15. The deadly *Amanita*. From a drawing showing the fungus in several stages of development from the egg to the mature plant (*Amanita phalloides*). About $\frac{1}{2}$ natural size.

Just as the fungus emerges from the volva, by the rapid lengthening of the stem, a second or inner membrane may be seen which joins the margin of the cap or pileus to the upper part of the stem and covers the gills from view. By the spreading of the pileus, this membrane is torn loose from its margin and clings as a loose ring upon the upper part of the stem, where it may be found in most species as long as the fungus lasts.

The following descriptions refer principally to the mature plant.

The Deadly Amanita (Amanita phalloides)—Poisonous.

Cap—Two to three inches broad; varying in color from nearly pure white to smoky brown in different varieties; smooth, often with one or more small patches of the whitish volva sticking to it.

Gills—Wide, numerous, white.

Spores—White.

Stem—Three to five inches high, enlarged at base, white or tinged with the color of the cap, pithy or hollow.

Ring—Curtain-like, near upper end of stem.

Volva—Cup-like or sheath-like, white or yellowish white.

Occurs in woodlands or recently cleared ground where leaf mold abounds. While this fungus has not been seen in this state by the author, it should be looked for and carefully avoided, as it is one of the most poisonous plants known, when eaten.



Fig. 16. *Amanita (amanita recutita)* young and mature specimens about $\frac{3}{4}$ natural size.

AMANITA

(*Amanita recutita*) Probably Poisonous

This amanita closely resembles the preceding species in most respects but the margin of the cap is marked with fine parallel lines or striations. The cap is light brownish in color and usually bears several small fragments or patches of the cup or volva upon the top.

The ring is lower down on the stem and the volva or cup is usually more shallow than in the former species, or in some cases appears to form merely a narrow border around the upper part of the bulb-like base of the stem.

This plant has been found several times by the author usually in the edge of thickets or groves of aspen and pine along streams in the mountains.

It should never be eaten as it is strongly suspected of being poisonous.

The Fly Amanita (*Amanita muscaria*)—Poisonous.

(See colored plate.)

Cap—Two to six inches broad, bright orange or scarlet, thickly sprinkled with small, yellow-white warts or fragments of the volva which stick closely to the smooth surface.

Gills—Usually white or sometimes faintly tinged with yellow, broad, numerous.

Spores—White.

Stem—Three to six inches long, enlarged and coated with scaly fragments of the volva at the base, pithy, becoming hollow, white or tinged with pale yellow.

Ring—Soft and clinging, often breaking and disappearing in old plants, yellowish white.

Volva—Soft, breaking up into ring-like scales or fragments which cling loosely to the enlarged base of the stem and sometimes disappear in old plants.

It occurs almost entirely among trees in moist places in gulches and mountain parks or in forests of Lodgepole pine. It is not uncommon, but is so striking in appearance with its brilliantly colored cap adorned with whitish warts that it can scarcely be mistaken for any other fungus. While perhaps not quite so deadly as the first species, it is very dangerous when eaten and has taken its toll of lives in almost every country of the world. The common name, "Fly Amanita," which has been applied to this plant, is due to its poisonous effect upon flies. The writer has seen specimens of this mushroom, left to dry in the open air, which were surrounded by a circle of dead flies that had fed upon this natural fly poison.

Undoubtedly, other species of *Amanitas* occur occasionally in our state, but any person who becomes familiar with those here described should have little or no difficulty in recognizing them as belonging to this genus. Any umbrella-shaped fungus which has *white* spores, a *ring on the stem* and a *volva at the base of the stem* is an *Amanita* and should not be eaten. These characters, together with the fact that these fungi are confined to woodlands or the near proximity of trees or recently cleared forest should make it readily possible to entirely avoid them.



Fig. 17. The Fly *Amanita* (*A. muscaria*) the largest specimen six inches across. Growing among trees on moist north hillside at about 6,500 feet elevation in the mountains. ($\frac{1}{2}$ natural size)

THE LEPIOTAS

The *Lepiotas* closely resemble the *Amanitas* in certain respects, as they have white or greenish white spores and a ring on the stem, while

Gills—Crowded, not quite reaching the stem, whitish at first then becoming greenish in color.

Spores—Dirty yellowish green.

Stem—Tapering upward from a somewhat swollen base, tinged with brownish, smooth or sometimes the surface becomes slightly cracked as in the specimen figured.



Fig. 18. Morgan's Lepiota (*Lepiota Morgani*) showing upper surface of a large specimen.

Ring—Thick and large, movable on the stem. Occurs mostly in open ground, in meadows or pastures, usually several or many individuals growing near together, sometimes forming a large ring or circle.

This fungus, while attractive in its large size and pleasing appearance, has the reputation of making at least half of the number of persons who eat it very sick for a time and should be avoided as dangerous. It is so unlike any other known mushroom which occurs in open ground in the color of its spores that it can be very easily shunned by taking care to determine this matter.

Smooth Lepiota (Lepiota naucina)—Edible.

Cap—Two to five inches broad, rounded, usually smooth and white, sometimes brownish and scaly, as in one of the specimens figured; flesh thick, white, or pinkish when old.

Gills—Numerous and crowded, white, later pinkish or brownish.

Spores—White, or pale pinkish in mass.

Stem—Two to four inches tall, tapering upward from the somewhat swollen base; white or colored like the cap, may be readily separated from the cap by bending it to one side.

Ring—Narrow, sometimes free on the stem.

Occurs occasionally in groups in rich lawns and in the vicinity of trees or hedgerows

room. It appears usually during the latter part of summer and early autumn and should be known to every lover of mushrooms.

ARMILLARIA (Edible)

In this genus the stem is continuous with the cap, therefore does not separate from it, as it does in the case of *Amanita* and *Lepiota*. In young plants the gills are covered with a membrane which separates from the margin of the cap and forms the ring upon the stem. One species, only, has been found in Colorado, the Honey Cap, (*A. mellea*), so-named because of the honey color of the whole plant.

It usually grows in crowded clusters either on the ground close to decaying wood or at the base of stumps or dead trunks. The cap ranges in size from 2 to 5 inches across and is usually honey colored or of some shade of yellow or brown. The upper



Fig. 20. The honey-colored *Armillaria*. (*A. mellea*). Growing at base of decaying alder stump along a mountain stream

surface is typically decorated with small scales of a darker color. The stem is rather tall, often twisted and bent and commonly shows the ring very clearly toward the top.

This is a very common species in the eastern wooded sections of the United States but is uncommon in Colorado. Its edible qualities are only fair.

LACTARIUS

The Lactarii might appropriately be called the milky mushrooms on account of the milk-like character of the juice. When a fresh specimen is wounded, especially if the gills are broken, a milky fluid oozes out readily unless the plant is rather old and partly dry. The milk varies in color in different species and ranges from white to bright yellow or orange.

In general appearance they are much like the Russulas, both in form and texture. Many of them possess a very acrid or peppery taste which is apt to discourage their use altho this property is said to largely disappear by cooking.

While some of the Lactarii are excellent, others have long been regarded as undesirable or even poisonous. It is probably best for the novice to try them cautiously at first.

They occur on the ground in mountain forests chiefly in late summer and autumn.

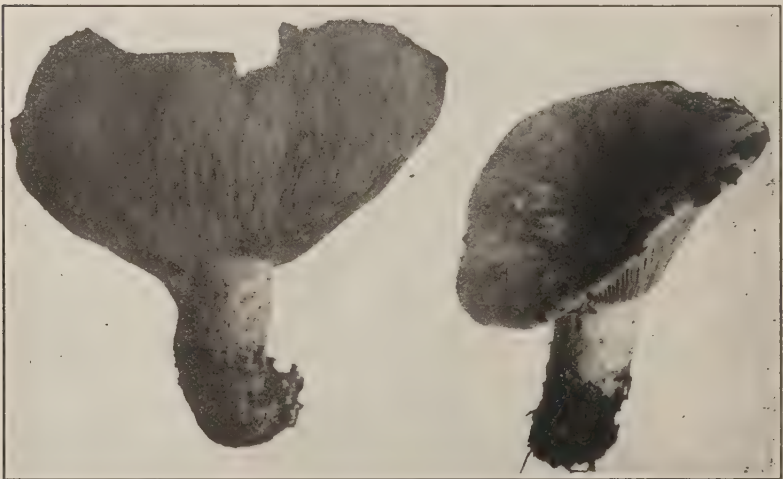


Fig. 21. A *Lactarius* which occurs in aspen groves. Note the droplet of milky juice exuding from the gills of the larger specimen.

THE RUSSULAS

The name, which means red or reddish, is taken from the color which is perhaps most common to the species of this genus. Other colors than red, however, are found among the russulas. These range from whitish, pinkish, yellow and orange to greenish, purplish, brown and almost black. In some species the cap is sticky and in others dry, while the surface may be smooth or in some cases cracked into small portions. The gills are usually white or yellowish and extend straight from stem to margin of the cap without intervening shorter ones, in some cases. They are very brittle in texture as is usually the flesh of the cap. The spores may be white or in some species pale ochre yellow but appear colorless under the microscope.

The stem is commonly rather short and stout, with spongy or solid interior and is entirely without a ring.

In Colorado the russulas are confined to the mountains where they occur on the ground among groves of aspen and in the ever-green forests during summer and autumn. Much difference of opinion has been expressed among authorities as to the edibility of certain species of this genus. Most of the earlier writers

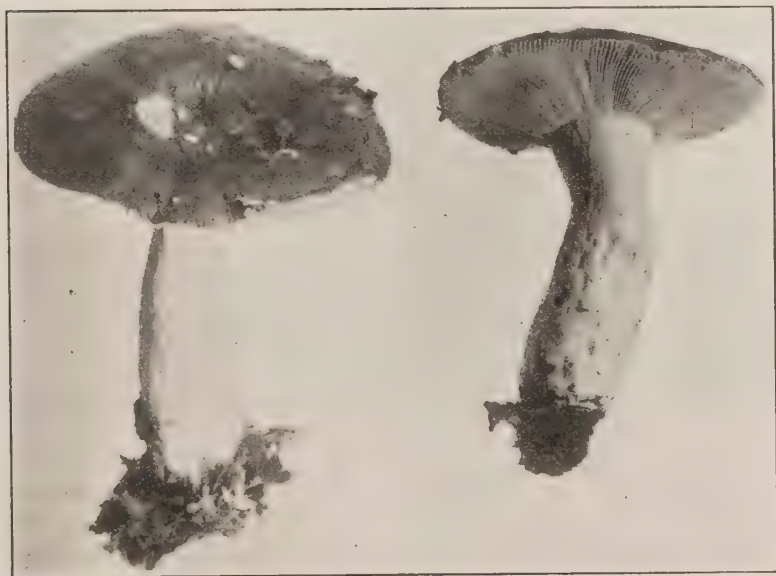


Fig. 22. A Red-capped *Russula* (*Russula* sp.) One of the peppery or acrid *Russulas* with bright red cap and ochre yellow gills and spores. The specimens grew in an aspen grove near a mountain stream at 7000 feet elevation. About $\frac{2}{3}$ natural size.

have claimed that those which are peppery or acrid to the taste are poisonous while one authority on edible fungi declares that not a single species is poisonous. In general there seems to be no objection to any of the russulas which are mild to the taste, when a small piece is chewed, and which have no strong nor offensive odor. Only the fresh sound specimens should, of course, be eaten. Squirrels are particularly fond of many of the russulas and apparently use them extensively during the season of growth.

TRICHOLOMA

The fungi of this genus often resemble those of *Lactarius* and *Russula*, in form at least. They differ from those of the former genus in having no milky juice and from the latter in being comparatively flexible and tough. Their most characteristic feature, however, is in the shape of the gills at the end next to the stem. Instead of joining the stem squarely or of extending down the stem the gills of tricholoma have an abrupt upward curve which forms a more or less pronounced notch between them and the stem.



Fig. 25. A white *Tricholoma* found growing under spruces in the mountains. About 1/2 natural size. Probably edible.

The cap is usually rounded at first but opens flat on top; the flesh is often quite thick and is continuous with the rather stout or robust stem. All of the species are edible except those with an unpleasant smell and none of these are dangerous.

One species which occurs rather freely at times in Colorado is the grassland *Tricholoma* (*T. praemagnum*). This has been



Fig.23

Fig. 23. The Common edible Mushroom (*Amanita muscaria*) showing three stages of development and section of one plant of natural size.
 Fig. 24. The Fly Amanita, poisonous mushroom (*Amanita muscaria*), showing two unexpanded young plants about three-fourths natural size.



Fig.24

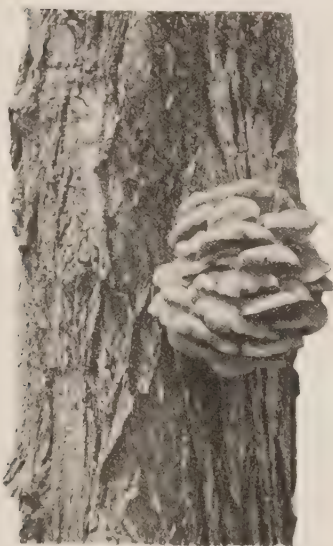


FIG. 26. The oyster mushroom (*Pleurotus sapidus*). Edible. A large cluster growing upon the trunk of a dead cottonwood.



FIG. 27. The oyster mushroom (*Pleurotus sapidus*). A small cluster from a cottonwood stump.

found once by the writer in a dry pasture on the plains but is quite common during rainy weather in late summer in the open grassland or meadows at elevations between 6,000 to 9,000 feet. It often grows in large circles or crescents and thus forms one of the so-called "fairy ring" fungi. It is nearly white in color with firm thick caps 2-8 inches across and short solid stem without a ring. It is edible.

OYSTER MUSHROOM (*Pleurotus sapidus*)—EDIBLE.

Cap—Two to six inches broad, shell-shaped, often quite irregular, smooth, smoky or wood brown in color. When young, moist and rather tough.

Gills—Not crowded, extending down onto the short stem, white.

Spores—White on black background, pale grayish or lavender on white background.

Stem—Very short or sometimes wanting, attached to one edge of the cap.

It grows in crowded masses or clusters, often of many individuals upon decaying stumps or logs of cottonwood, poplar and similar wood. This fungus can often be found year after year in the same places and occurs almost thruout the season when the moisture conditions are favorable. The caps should be used while comparatively young as they become tough with age and are also apt to be infested by insect larvae if left for some time.

ELM TREE PLEUROTUS (*Pleurotus ulmarius*)—EDIBLE

This species closely resembles the preceding one except that it usually has a longer stem which is more nearly central in attachment to the cap and the color of the fungus is white or yellowish. It grows mostly upon dead elm wood and is usually solitary. Like the other species of *pleurotus* the flesh is rather tough.

CORTINARIUS

Among the ochre or rusty spored fungi the genus *Cortinarius* is readily recognized by the presence of silky or cobwebby threads which connect the edge of the cap with the stem. This feature is most readily seen in young plants in which the cap is partly opened or expanded. Later, when the cap is fully opened the threads may be largely broken altho some of them often remain in the form of an indistinct zone around the stem.

More than 50 species of *Cortinarius* have been recognized by botanists in Colorado alone and only the expert is able to



Fig 28. Elm tree *Pleurotus (Pleurotus ulmarius)*. Edible. Single specimen growing from decayed part of an elm tree.

separate them. None of them, however, are known to be poisonous altho many of them have but little food value. They occur only on the ground, in groves of aspen and in evergreen forests of the mountains during summer and autumn.

STROPHARIA

The fungi of this genus are most commonly found growing on the droppings of grazing animals in pastures. They are mostly rather small in size with thin flesh. The cap is sticky at first and the ring often disappears or leaves merely a line around the stem when the plants are old. The spores are dark purplish brown.

All of the species which have been recorded for Colorado are considered edible; however their small size and rather sparse occurrence together with a rather uninviting appearance are not apt to attract the average person.



Fig. 29. A yellowish-brown species of *Cortinarius* common in aspen groves along streams in the mountains in summer. About 2/3 natural size.

COMMON MUSHROOM, MEADOW MUSHROOM
(*AGARICUS CAMPESTER*)—EDIBLE
(See colored plate.)

Cap—Two to five inches broad, broadly rounded, or flattened when mature, varying from smooth to silky hairy or minutely scaly and from white to grayish or reddish brown.

Gills—Broad, crowded, at first pink, gradually becoming dark purplish brown as the cap expands and matures.

Spores—Purple-brown.

Stem—Two to four inches tall, thick, solid or spongy within, colored like the cap.

Ring—Soft and delicate, often disappearing with age.

It occurs in open grassy ground, pastures and meadows during summer and autumn. This is the fungus known to most persons as the Mushroom. It is the common mushroom of the markets where it may appear in the fresh condition from the local mushroom cellars, or in tin cans from across the sea.

(Brief directions for the growing of mushrooms will be found on page 46.)

Several other species of *Agaricus*, which closely resemble the common mushroom, are occasionally found in Colorado. One of these, the horse mushroom (*Agaricus arvensis*) occurs most often in pastures and uncultivated ground. It resembles the

common mushroom very closely but is sometimes of larger size and the caps and stems which are white or yellowish become yellowish when bruised. It is an excellent edible species.

The Reddish Agaricus (A. rutescens)

This plant differs from the two preceding species in growing usually under spruces in the mountains, in its generally reddish or brownish red colors, especially where bruised or cut, and in its almond-like odor and taste. It is of excellent edible quality.

THE HYPHOLOMAS

The fungi of this genus resemble those of *Agaricus* in the color of their spores, which are purplish or brownish purple, but differ from them in having no well developed ring or collar on



Fig. 30. The semi-globular *Stropharia* (*Stropharia semiglobata*). A common species of *Stropharia* found growing on dung especially in horse pastures. About 3/4 natural size. Edible but rather unattractive.

the stem. In very young specimens a thin membrane or veil may often be seen between the edge of the cap and the stem but as the cap expands this is torn apart and either disappears or in some cases remains in the form of small fragments clinging to the margin of the cap.

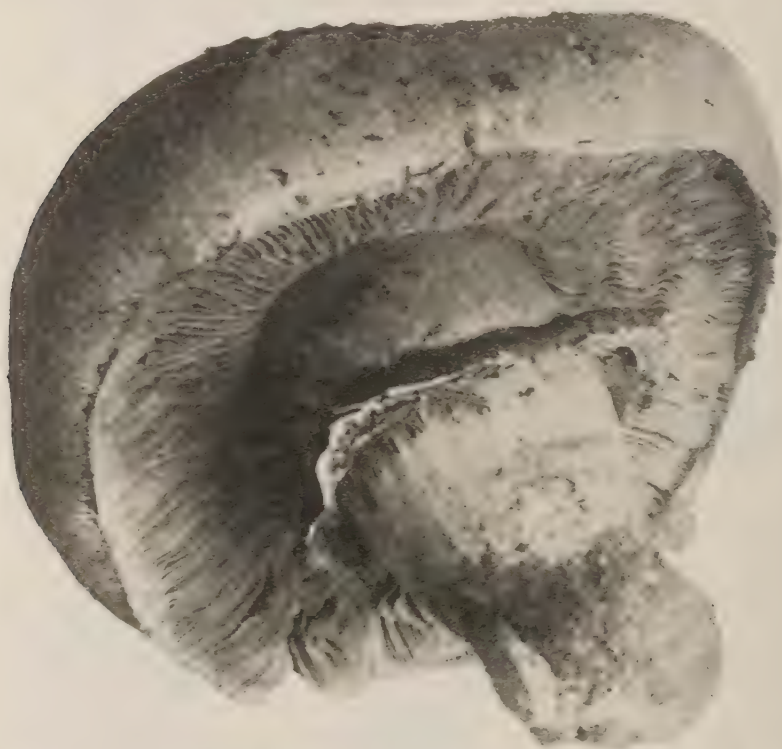


Fig. 31. A well-developed specimen of the common mushroom. Natural size: weight 6 1/2 oz.

The *Hypholomas* commonly occur on the ground close to stumps or where decaying wood is buried in the soil. All of the species which commonly occur in Colorado are edible.

Small Hypholoma (Hypholoma incertum)—Edible

Cap—One to two and a half inches broad, broadly conical or bell-shaped, with thin wavy margin to which fragments of white membrane are attached; dull yellowish or brownish white, showing purplish tinge near the margin, flesh very thin and tender.

Gills—Narrow, crowded, joined to the stem; nearly white at first, becoming purplish brown.

Spores—Purplish brown.

Stem—One to three inches tall, slender, hollow, white.

Occurs in lawns and moist grassy places. While the individual specimens are small and the flesh thin, this is usually compensated for by the large numbers which often grow together as shown in the photograph.



Fig. 32. The Horse Mushroom (*Agaricus arvensis*)

THE COPRINI OR INKY CAPS (COPRINUS)

These plants form a very characteristic group of the gill fungi. They are often very abundant during or following rainy weather and are familiar objects to everyone. Evanescence is one of their chief characteristics. Some of them literally spring up in a night, spread their fragile caps for a brief period, and vanish at the sun's touch. Others are more enduring, remaining for a day or two, but seldom longer, soon drooping into a slimy mass of inky dejection very aptly suggestive of the common name "inky caps."

In this condition of sudden collapse they are not calculated to prove very inviting to the mushroom collector, but if gathered before the caps expand and while the gills are still light colored, they are excellent eating. Furthermore, none of the species are known to be poisonous and are easily distinguished from any of the poisonous fungi.

The caps of these fungi when young are folded close to the stems with the thin, delicate gills packed closely together. The gills are white or light colored, at first, but soon become darker, passing thru various shades of pink, purple, and brown, to black, finally melting into an inky liquid. The color of this liquid is due entirely to the black spores which it contains and which are largely set free in this way. The three species described are the most abundant and desirable kinds for food.



Fig. 33. The reddish Agaricus (*Agaricus rutescens* Pk.) Specimens about 1/2 natural size.

The Glistening Coprinus (Coprinus micaceus)

This mushroom often grows in dense clusters of many individuals at the base of decaying trees or stumps, near an old door step, or at the edge of a sidewalk. Sometimes it appears in the open lawn, but this is usually an indication of the presence of buried wood in the soil. The caps when folded are conical, oblong or egg-shaped, with fine grooves running lengthwise. The color is yellowish, brownish yellow, or tan, while the surface is frequently sprinkled with glistening, mica-like particles that give this mushroom its name. These shining particles do not a'ways appear on the caps, however. In young specimens the margin of the cap is at first slightly attached to the stem near the base and leaves an encircling ridge where it breaks away. The stems are quite slender, smooth, white, with a narrow hollow and are

easily broken. The gills, at first white, change thru brownish purple to black and in rather dry weather they shrivel and dry up instead of melting into ink.

The Glistening *Coprinus* occurs mostly during late spring and early summer, but is not infrequently found during the autumn following rainy weather.

Inky Cap (Coprinus atramentarius)

This is a somewhat larger mushroom than the glistening *coprinus* and is readily distinguished by the shape and color of



No. 34. The small *Hyhcloma (Hypholoma incertum)*, growing in profusion in a lawn around an old cottonwood stump. Edible.

the caps. It usually occurs in grassy places where the soil is rich, many often crowded together, the short stems being almost hidden from view. The caps are from one to two inches high, oval or egg-shaped, sometimes slightly indented at the top, and of a gray or brownish gray color. The caps have fine lines extending to the margin, some of them being quite deep grooves and in consequence the margin is apt to be rather irregular. It leaves a rather prominent ridge where it was attached to the stem. The surface of the caps is frequently quite scaly, due to the break-



No. 35. A cluster of the small *Hypholoma*. Natural size.

ing up of the surface during growth, while in other forms the longitudinal striations or fine grooves are alone present. The caps when open assume a flattened bell-shape with the margin usually upturned and rolled back. The stems are white, smooth above and somewhat scaly or rough below the ridge-like ring and are comparatively short at first, but lengthen as the caps expand, often reaching a height of six inches. It is oftenest found during summer and autumn.

The Shaggy-Mane (Coprinus comatus)

This is the giant of its group, occasionally growing eight inches high with the cylindrical pileus two and a half to four inches long. It grows in much the same places as the inky-cap mushroom, frequently appearing in profusion year after year in the same spot in some rich, moist lawn or grassy place where filling or grading has been done with fertile soil. It may appear in June, but is apt to be more abundant in the rainy part of autumn. The caps are longer than in either of the two preceding species, being nearly cylindrical or barrel-shaped when young. Their most noticeable feature, however, is the shaggy surface formed by the breaking up of the fibrous outer coat into tufts of delicate threads. These tufts are usually pointed at the lower part where they begin to separate from the cap and are sometimes tipped with brownish or blackish pieces, thus making them conspicuous on the white, fibrous layer beneath. The top of the

cap is usually overlaid with a ragged piece of the same color. Altho considerable variation in different plants may be found, they are so characteristic in appearance as to be unmistakable when once identified. As the margin of the cap breaks loose from the stem, by the rapid lengthening of the latter, it leaves the veil in the form of a narrow ring which unlike that of either of the above species, is free and movable on the stem. Soon after this occurs, the lower part of the cap and the gills begin to darken, the latter at first becoming a pinkish salmon color, gradually deepening to brownish and then black when the melting process begins. At this time, too, the cap gradually expands, assuming the shape of a bell, then becoming more flattened with the dissolving margin dripping with inky juice. At length, only a small portion remains but this, too, soon gives away, leaving the naked stem standing, a slender monument to its final dissolution. The white stem when split lengthwise is seen to be hollow and to contain a stand of mycelial fibers extending thru it.

THE PORE OR TUBE FUNGI (POLYPORACEAE)

This family includes a large number of kinds but all are alike in the fact that the spores are borne on the walls of tubular



Fig. 36. The Glistening Coprinus. A cluster growing in a lawn where a cottonwood tree has been removed.

or pore-like openings in some part of the plant body. In shape they may consist merely of a thin fungus layer on sticks or trunks of wood, in the simplest forms, or as brackets, shelves or hoof-shaped outgrowths on logs, stumps and trunks of trees, or of umbrella shaped plants with central stems growing on the ground.

In the simplest kinds the pores are merely very shallow pits in the surface of the fungus while in the other forms the pores



Fig. 37. The Glistening Coprinus (*Coprinus micaceus*) showing four stages in the development of this mushroom.

open on the lower side of the plant as it grows. The pores in most species are very small and often appear like tiny holes closely crowded together.

BOLETUS

The species of Boletus resemble the common gill fungi in shape as they consist of a cap or pileus borne on top of a stem. Instead of gills, however, a Boletus has a layer of tissue perforated with numerous pores or tubes within which the spores are borne. The most common colors are brown, yellow, red and purplish. The cap may be shiny or sticky in some or dry in others. The flesh is either whitish or yellowish and in some species changes quickly to a bright blue when broken or wounded. The spores are some shade of yellow or brown and the stem may in some cases have a ring or collar.

In most species of Boletus the flesh is rather soft and may be somewhat slimy when cooked, especially if the layer of tubes is not first removed. Some species of Boletus have a very bitter taste and should not be eaten on this account. The genus is a large one and considerable difficulty is apt to be experienced by the amateur in identifying them. While a few of our species are probably desirable they are not apt to prove as attractive as the gill fungi. Some species are regarded as poisonous so that as a group they are best avoided for food or at least should be tested with caution.



Fig. 38. The Inkycap mushroom (*Coprinus atramentarius*). Elkhä.



Fig. 39. The Shaggy Mane mushroom (*Coprinus comatus*), showing the different stages in the development of the fungus. Edible.

The Granulated Boletus (Boletus granulatus) Edible

This is a rather common species of small size usually 2 or 3 inches broad, with a sticky yellow or brownish yellow cap, thick yellowish flesh, light yellow tubes and short yellowish stem.

The stem and the edges of the tubes are commonly granulated with minute dark specks or granules from which the plant gets its name.

It occurs in open places among trees of pine and aspen during mid-summer and early fall.

MANY SPECIES OMITTED

As it is impossible in the pages of an ordinary bulletin to describe and figure more than a small number of the fleshy fungi which occur in Colorado only the more common and easily recognized kinds have been considered. Many other genera than those



Fig. 40. The Granulated Boletus (*Boletus granulatus*). Edible. About 2/3 natural size.

here treated are represented within our borders and our foothills and mountain forests at times abound with them. For the person who desires to know more about these interesting but largely unfamiliar plants, the reader will find such information in the following works:

"Mushrooms, Edible and Otherwise," M. E. Hard, The Ohio Library Co., Columbus, Ohio.

"Some Common Edible and Poisonous Mushrooms," Patterson & Charles, Farmers' Bul. 796, U. S. Dept. of Agr. 1917. 24 p. Price 5 cents.



Fig. 41. The beautiful *Boletus* (*Boletus amabilis* Pk.) This is a handsome plant with reddish purple fibres upon a brownish yellow background, a yellow ring on the stem, and purplish markings on the yellowish stem. The flesh is yellow and firm and does not change color when cut. The pores are brownish or purplish where bruised. It grows in mixed woods along mountain streams in summer but is not plentiful. Its edible qualities are not known to the author.

"Mushrooms and Other Common Fungi," Patterson & Charles, Bul. 175, Bureau of Plant Industry, U. S. Dept. of Agr. 64 p. Price 30 cents.

"The Mushroom Book," N. L. Marshall (Doubleday, Page & Co.).

"Minnesota Mushrooms," F. E. Clements (University of Minnesota, Minneapolis, Minn.).

"One Thousand American Fungi," McIlvaine. 1912. Bobbs-Merrill Co.

FOOD VALUE OF MUSHROOMS

The food value of mushrooms has often been greatly overstated. When compared with other food materials such as bread, meat, eggs, etc., it has been found that they come far short of these staples but fall in a class along with the root vegetables. This is due largely to the high content of water in proportion to their solid matter, not all of which is digestible. Thus they range in water content from about 10 percent to 95 percent, the common mushroom having an average water content of 88 percent when fresh. The food value of the fleshy fungi is greatly enhanced, however, by the usual methods of cooking and preparing them by the addition of milk, butter, flour and meat juice. Their chief value probably lies in their use as relishes or as adjuncts to other more nourishing foods. The possible value of fleshy fungi as a source of vitamins appears not to have been investigated at least so far as the author has been able to learn. Their close relationship to the yeast plant, which is recognized as a valuable source of the water soluble vitamins B, might indicate an unrecognized value from this standpoint.

GATHERING FLESHY FUNGI FOR FOOD

In collecting any of the fleshy fungi for eating, the same general precautions should be taken as with any other food materials. All specimens that are over mature or that are infested with the larvae of mushroom-eating insects should be discarded. Puffballs should be white inside when cut or broken open. Yellow or brownish stains near the base or in the center indicate approaching maturity and, altho not necessarily poisonous in this condition, the fungus is apt to be bitter and unpleasant in flavor.

Care should be taken in removing the mushrooms from the soil so that adhering dirt will not be left on the specimens while carrying them. This will often obviate the necessity of washing the fungi before cooking and it is always very difficult to remove the soil from the gills of mushrooms which have been carelessly handled. An ordinary lunch basket is an excellent receptacle for carrying the mushrooms and it is desirable to wrap the larger specimens in thin paper before putting them in the basket.

MUSHROOM COOKERY

Almost as many culinary methods have been employed in the preparation of mushrooms for the table as for the various kinds of meats. In fact, they are adapted to almost any treatment given to meats, fish, fowl and eggs. Thus they may be stewed, baked, fried, broiled and escalloped, made into croquettes and patties or mixed with chopped meat and baked into a loaf, while they form a pleasing addition to thickened gravies and stuffing.

The tougher kinds, such as pleurotus, are adapted to stewing and require forty to fifty minutes. They are also readily prepared by grinding in a meat chopper and mixing with chopped beef for the filling of pattie shells or for the making of meat loaf. The puffballs are very daintily served by being sliced, dipped into egg batter, the same as for French toast, and fried in butter until lightly browned.

The very tender species, such as the Coprini or Inky-caps, are well suited to being served on toast after being stewed for fifteen to thirty minutes and thickened with a flour and milk sauce to which a little butter has been added.

Almost any of the various species are well suited to being baked with cracker crumbs after the manner employed in preparing escalloped oysters or tomatoes and a mixture of kinds can be utilized at one time in this manner. Almost any good cook book will be found to contain numerous recipes for mushroom cooking, only a few of which are mentioned here.

MUSHROOM CULTURE

The successful raising of mushrooms under cultivation is a process which calls for greater care and attention to details combined with suitable conditions for their growth than does the growing of the ordinary garden crops. By success is meant a full crop of well formed mushrooms of good size, free from insect larvae, and produced over a considerable period of time.

It is possible, of course, for almost any garden enthusiast to raise a few mushrooms for home use on a small scale and with rather poor equipment. The writer has succeeded in producing them in a vacant horse stall with wild or native spawn taken from an old hotbed. This method, however, could not be advocated for general use especially where a profitable enterprise is desired.

Advertisements to the contrary, the writer does not believe that everybody can raise mushrooms readily. Certainly it is unwise to launch forth in the business on a commercial scale with little or no experience and with the expectation of making easy

money. It would seem best, therefore, to learn as much about the subject as possible by studying bulletins and books which give the full particulars and then to try out the matter on a small scale. In this way a person will soon learn the problems connected with the industry and will gain some invaluable experience.

The most important requirement for mushroom culture is a suitable place. This may be in a cellar under a dwelling, in a cave, a mine tunnel or in a specially constructed mushroom cellar similar to those employed for the storage of vegetables over winter. It should be a place in which the air can be kept moist, with no strong draft, and where the temperature may be kept above 50 degrees F. and below 70 degrees F. It is best also that light be excluded from the mushroom beds as this helps to keep away certain insect pests which infest the crop whenever it is exposed to them.

The material used in forming the mushroom beds is chiefly fresh or unleached horse manure without coarse bedding material or long straw, and preferably from grain-fed animals. This is piled to a depth of about 3 feet, after being moistened, and allowed to heat for a couple of days. It is then forked over and mixed and more water sprinkled on if it shows dry places or a tendency to burn. This process is repeated for about 10 days or 2 weeks or until the first strong heat has subsided. Some growers mix with the manure, during this process, about one-third of its bulk of old sods chopped in pieces, or of good garden soil.

The material is in a proper condition when it is dark brown in color, moist, but not wet, has no objectionable odor, and has a temperature not above 90 degrees F.

Mushroom beds are then formed by spreading the material upon the floor or bottom of the cellar or other place where they are to be made, and packing it down firmly and evenly to a depth of 8-10 inches. The beds should be enclosed around the sides by boards set on edge. If desired beds may be made on wide shelves one above another so as to fully utilize the space in the cellar.

When the temperature of the beds has fallen to about 75 degrees to 80 degrees F. they are ready to be spawned. The spawn usually comes in the form of bricks which should be broken into pieces about the size of a walnut or small egg. The pieces are then planted in holes 2 inches deep and about a foot apart all over the beds.

After about a week or 10 days a layer of about one inch of good garden soil is spread evenly over the beds which should not be allowed to dry out. In a damp atmosphere free from drafts no watering should be needed but if dry a light sprinkling of warm water is called for occasionally.

The crop of mushrooms should begin to appear about 5 to 8 weeks after spawning and continue for a period of 8 to 12 weeks. The mushrooms should be gathered daily or at least every other day and should be sorted and placed on the markets with as little delay as possible.

Some recent experiments at the New York State Agricultural Experiment Station have shown that the addition of about 60 pounds of cottonseed meal to 100 cubic feet of the fermented manure greatly increased the mushroom crop.

Pure culture spawn can be obtained from the large dealers and possesses some advantages over the ordinary spawn. Most of the larger seed firms handle the spawn and with it printed instructions for growing the mushrooms.

The following books and pamphlets on the growing of mushrooms are desirable for the person who intends to raise them on a commercial scale:

"Experiments with Cottonseed Meal in Mushroom Cultivation," F. C. Stewart, New York State Agricultural Station Bulletin 546, July 1927.

"The Cultivation of Mushrooms," Farmers' Bulletin 204, B. M. Duggar, 1916. U. S. Dept. of Agr., Washington, D. C. Price 5c.

Farmers' Bulletin 789, "Mushroom Pests and How to Control Them." U. S. Dept. of Agr. Price 5c.

"Principles of Mushroom Growing and Mushroom Spawn Making." B. M. Duggar, U. S. Dept. of Agr. Bureau of Plant Industry, Washington, D. C. Dept. Bul. 85. Price 10c.

"Mushroom Growing," Duggar, B. M. 250 p. Published by Orange Judd Co., N. Y.